SCIENCE.

FRIDAY, OCTOBER 1, 1886.

COMMENT AND CRITICISM.

CONTAGIOUS PLEURO-PNEUMONIA has broken out to such an extent in Illinois as to call for most prompt and vigorous measures on the part of the state authorities. This disease has prevailed in this country to a greater or less extent among the bovine species since 1845, when it was introduced in Brooklyn from Holland. Kings county and the city of Brooklyn have been hot-beds of this form of cattle-plague from that time to the present. The state authorities attempted some years ago to eradicate it, but failed. The local health authorities have also endeavored spasmodically to root it out, but it still exists to a greater or less extent on the western end of Long Island. We notice in the daily press, that the owners of the distilleries in the west who profit by the sale of swill to the owners of the cows in the affected districts claim that there is no danger from the milk of the diseased cows, as they do not yield any. This claim is utterly without foundation. The milk becomes reduced in quantity, but often continues to be secreted throughout the attack. This effort is made to delude the authorities and the public, in the fear, that, if compelled to destroy such milk, their revenue will be much reduced. The producers of swill-milk need the closest watching. Any one who will feed his stock upon such food will not hesitate to palm off upon the public the milk from the most diseased animals as being 'pure Orange county milk.' The people of the whole United States are affected by unwholesome meat, which finds its way into the Chicago stock-yards, and have a right to demand of the authorities, municipal, state, and national, that every precaution shall be taken to keep from the shambles animals sick or suspected to be affected with any disease which tends to produce sickness in the consumers. Fortunately, there is little danger from the milk for those at a distance, but the refrigerator-cars may bring to the door of every one the meat of animals killed in the slaughter-houses of Chicago.

THE SUPERVISORS OF KINGS COUNTY, N.Y., are bearing the onus of the charge of interfering with the proper care and recovery of the insane poor of that county. Although a large sum of money has been expended to purchase a farm at St. Johnland, Long Island, with the object in view of removing at the earliest possible moment the insane who are now crowded in the Flatbush asylum, and although every financial provision has been made to erect cottages for their proper protection, still this board neglects, week after week, and month after month, to take such action as will make possible the attainment of this end so much to be desired, and for which philanthropists have been working for so many years. The general impression prevails that the supervisors are actuated by motives which are, to say the least, very questionable, and the press is calling the attention of the grand jury to the matter.

THE NOTICE THAT HACHETTE of Paris is issuing a series of historical and archeological monographs of French towns is important as showing the increasing desire to make history something more than a dreary record of rulers and wars, and to make it tell the story of the people. In this series the volumes on Blois, Tours, Rheims, Nimes, Chartres, le Mans, Angers, Nantes, St. Malo, and Dinard, are already published. In the records of these towns and in their development are to be learned valuable lessons, and much of by no means antiquated social and political interest. In centres like these the people's life was truly lived, and it remains for the conscientious and industrious historian to reveal it to us. In England, similarly, the cathedral towns and the various shires are receiving attention; and American scholars are describing our early town and village societies, as well as tracing the development and administration of our large cities. Thus history is made; and it is owing to the broader and clearer idea of what history really means, which now prevails, that students are turning in increasing numbers to these important sources of information.

GLANDERS IS REPORTED to exist among the horses of Brooklyn and in a large stable at Coney Island. It is believed to have been spread by means of the watering-troughs, the affected animals soiling the troughs with the discharge of the nos-

trils, which thus communicates the disease. Infecting the horses is not the only danger to be feared: numerous cases are on record where grooms, and others whose duties brought them in contact with the diseased animals, have become themselves diseased, and have in most cases succumbed after suffering the most excruciating torture. The health and other officials should make every effort to discover infected horses, and to isolate them until they can be destroyed. The probabilities of recovery are so slight, and the danger both to animals and man so great, that the retention of the glandered beasts in public stables, or their passage through the streets, should not be permitted. Like the Indian, the only good glandered horse is a dead one.

THE BAD EFFECTS of the use of circular curves on city railways is shown in a striking way in Philadelphia, where the cable-road on Market Street has to make eight right-angle turns (four for each track) in passing around the public buildings on Broad Street. The harm is not only in the sudden development of centrifugal force in passing from the straight tangent to the circular arc, but also in the sudden starting and stopping of a moment of rotation — a turntable movement — as the car runs on and off the curve. In passing around the curve, every car is rotated through ninety degrees at a uniform rate; much as if an engine on a turntable were suddenly set turning, then moved steadily, until it as suddenly stopped. It is manifest that great strains are caused by such violent changes of motion, not only on the cars, but on the cables as well; and it would be worth while to go to much trouble and expense in the construction of parabolic curves in the beginning, to save wear and tear in the long-run. Horse-cars feel the bad effects of circular curves less than the cable-cars, because the velocity of the former can be adjusted to the occasion by good driving; while the latter move steadily and rapidly, without any allowance for the strain on the cars and the stretch of the cable that the curves produce. It is curious that so antiquated a device as the circular curve should survive in a construction involving so much special and ingenious arrangement as a cable-road.

THE CONSUMPTION OF TEA has become so enormous as to have suggested a study of its effects upon the health of the people. There are those who look upon it as an evil only second to that connected with the excessive use of alcohol. Tea is spoken of as an agreeable cerebral stimulant, quickening intellectual operations, removing headache and fatigue, and promoting cheerfulness and a sense of well-being. When it is used to excess, the digestive and nervous systems are especially affected. There is no doubt that there are cases of dyspepsia caused by the inordinate use of strong tea; and it is also a matter of common observation that sleeplessness, palpitation of the heart, and nervous irritability often follow the prolonged use of this beverage. Tea-drinkers, by which we mean those who use tea to excess, are to be found in all classes of society. The fact should be impressed upon such persons, that tea is not a food, and cannot therefore, without risk to health, be substituted for articles of diet which form both flesh and bone.

ANOTHER FATAL RESULT from the administration of chloroform is reported from Dallas, Tex. The patient was a vigorous Swede forty-one years of age. He was suffering from diseased bone, due to a gunshot wound received during the late war. There were two of the most careful and skilful physicians present, who exhausted all available means for his restoration to life, but their efforts were fruitless. This case illustrates in a most striking manner the great and unavoidable danger connected with the use of chloroform as an anaesthetic in surgical operations. This patient was examined prior to its administration, and pronounced free from any heart or other disease which would contra-indicate the use of chloroform; and yet while the anaesthetic was being given, with the surgeon's finger on the pulse to detect the first evidence of danger, the heart stopped beating instantly, nor was there any pulsation after that moment. As we have already said, and as we propose to continue to say whenever opportunity offers, the administration of chloroform in surgical operations is ordinarily unjustifiable, and, unless the surgeon can give some good reason for using it instead of ether, he should be held civilly and criminally responsible in case of the death of his patient.

MUCH HAS BEEN WRITTEN on the subject of mysterious noises, which in most cases, if intelligently inquired into, would be found to have no mystery at all about them. A professor at Philadelphia recently recorded that at a certain hour

each day one of the windows in his house rattled in the most violent manner. On consulting the local railway time-table, he could find no train running at the hour specified; but on examining another table, which included a separate line, he found that a heavy train passed at the time at a distance of several miles from his house. He then referred to the geological formation of the ground between the two points, and at once saw that there was an outcropping ledge of rock which formed a link of connection between the distant railway line and his home. It was the vibration carried by this rock from the passing train that rattled the window.

A REMARKABLE LAND-SLIDE.

THE U. S. geological survey has learned from Mr. C. W. Cross, engaged in field-work at Denver, Col., the particulars of a remarkable land-slide near Cimarron, Gunnison county, which was described in the local papers as an earthquake. Professor Farnham, of the Nebraska state normal school, who chanced to be in the neighborhood, had personally visited the scene of the supposed earthquake; and when he called upon Mr. Cross, and described the appearance of the region, the fissures formed, etc., the latter inferred that a serious disturbance must have occurred along the line of faulting on the west side of the Trident mesa, indicated on the Hayden maps. As soon as practicable, Mr. Cross went to Cimarron. He found the locality about nine miles south of that town, on the east side of the west fork of the Cimarron River. Between the two forks of the Cimarron is a mesa capped by eruptive rock, the valleys on either side being eroded out of cretaceous rocks, apparently the clays of the Colorado group. The area involved extends from the base of the cliffs of eruptive rock forming the top of the mesa, down the slopes toward the valley bottom, nearly to the edge of the belt of timber. Such a crumpling of the surface had taken place, — throwing down forests in inextricable confusion, pushing the ground up into ridges, and leaving fissure-like depressions, — that the assumption by untechnical persons of an earthquake as the cause was not surprising; but, after a two-days' examination, Mr. Cross satisfied himself that there had been no earthquake, but a remarkable land-slide, involving an area of nearly two square miles. It was evident that the surface of the ground had become loosened from the underlying clay beds, probably in consequence of the sepage of water, and that a movement of the area, starting at its upper end, had been thereby instituted in the direction of the mesa. The lower portion having moved less, or not at all, the ground there had been most thoroughly ridged, fissured, compressed, and overlapped, in such a manner that trees had been overthrown, little ponds drained and new ones formed, and the courses of small streams changed. Ranchmen living near by had preceived no tremor or other evidence of earthquake disturbance, nor could they tell when the movement took place; but they agreed in saying that the rainfall had been unusually heavy. Evidences were found of similar land-slides of earlier date, at various places along the valley, and it seems clear that such slides must have played an important part in shaping out the valley depression.

THE 1886 PRINCETON SCIENTIFIC EXPEDITION.

AFTER a most successful working season of over ten weeks, the Princeton scientific expedition has returned from its explorations in the Bridger beds, south-western Wyoming, and the White River country, north-eastern Utah. It will be remembered by those familiar with the history of bad land explorations that this is the sixth expedition that Princeton has sent out to the west. Since 1877, Prof. W. B. Scott and his coadjutors have worked in the Bridger beds and Bitter Creek country of Wyoming, in the White River of Dakota country, in the Yellowstone region, and now in the White River basin in Utah. The result is that the Princeton museum has now a splendid collection of American fossils, less complete, it is true, than Professor Marsh's collection at New Haven, but in some important respects quite equal to it.

The expedition this year started in June last, under Professor Scott's personal direction; but, after the first two weeks, he was obliged to return east, and his place as leader and director of the work was taken by Mr. Francis Speir, jun., of Princeton (1877), who has had wide experience in the western bad lands. Mr. Speir had under his command seven men (mostly Princeton students), a guide, and a cook.

Fort Bridger was the original base of supplies, and the first working camp was on Henry's Fork, an important tributary of Green River, about thirty-five miles south of the fort. Work was begun near the spot where a fine skull of Uintatherium was found last year, and careful search resulted in exhuming the remainder of the skeleton nearly complete, and in excellent preservation. Twin Buttes, a spot some thirty miles to the east, was the second working camp, and in that vicinity was found an extraordinarily perfect skeleton of Mesonyx; and it is believed that Princeton will

now possess the only skull of a carnivore of the American eocene.

This work on the south slope of the Uintah Mountains was only preparatory to the main aim of the expedition, — the exploration of the little-known White River country. The passage of the Uintahs was quite difficult, for the climbing is very steep and the road very poor. The road bears off to the eastward, and crosses the range at an elevation of over ten thousand feet. The scenery was very wild and grand, and the air delightful. The nights were always very cold, and on the night of July 25 there was a severe frost. The descent into the Ashley valley on the south slope is very fine, and the views toward Salt Lake City in the west, and the Colorado mountains in the east, superb. The valley of Ashley's Fork, another tributary of Green River, has by wonderful irrigation and great care become of much agricultural value, and is now supporting a considerable population, almost entirely Mormon. From the settlement of Ashley to Ouray, the agency of the Uncompahgre Ute Indians, is a long, hot ride of thirty-five miles through a desert country in which some of the cañon formations are most curious.

Ouray agency is on the west bank of the Green River, just above the mouths of White River, flowing in from the east, and Duchesne River, a tributary from the north and west. Green River was crossed here, — a work of great difficulty, because of the swiftness of the current and quicksand bottom, — and the march continued almost due east, following the north bank of White River. Camp was pitched in a small cottonwood grove, the only trees for miles and miles, in a bend of the river, and work prosecuted from there. No fossils were found within two miles of camp, and at the conclusion of the work the ride out was from twelve to fourteen miles. The expedition's work was well organized; and men detailed to dig out and pack followed the prospectors, who located the fossiliferous strata and particular outcroppings of bone. No bones of any account were found, save in the two white or gray strata, the one lying at the base of the buttes, and the other some thirty feet above it, with two distinct strata intervening.

The prospectors soon discovered much of interest and value; and when camp was broken, and the march back begun, some twelve or fourteen hundred pounds of fossils were ready for transport. Every thing was packed with greatest care; cotton, tissue-paper, wrapping-paper, canvas sacks, and thin gunny sacks being used for teeth and joints, and all save cotton being used in every instance.

Of Amynodon, which the expedition desired particularly to get, numerous fragments were obtained, enough to make one nearly complete skeleton and the major part of several others. Tapiroids were found in great abundance, and it is not improbable that careful study will reveal some unique specimens among the finds of this expedition. The bones are not all in the best preservation, though some are in a far better state than others found immediately adjoining. The real scientific value of the expedition will only be known when the authorities of the museum make a careful study and description of the bones found.

The weather on White River was intensely hot by day, and very hot even at night. Mosquitoes were in abundance; and the river-water, while not strongly alkali, is warm and insipid. There is absolutely no vegetation save grease-wood and scanty sage-brush, and no animal life beyond small snakes and lizards and a few rabbits. The snow-topped Uintah range was in full view, and thunder-showers could be seen there daily. But in this White River desert it never rained, and it was asserted that it had not rained there since April, 1885.

The third week in August the White River country was left behind, and the long, slow march over the mountains began. Perhaps the country was left none too soon, for the Indians were very insolent, and, even on crossing the mountains, General Crook was passed going into that country with a detachment of cavalry and infantry to locate a new military post, as a safeguard against Indian treachery and violence.

The expedition is greatly indebted for its comfort to the aid rendered in outfitting by the war department and the quartermaster-general of the state of New Jersey, and for courtesies extended by the officers at Fort Bridger and the officials at the Ouray agency. For its scientific success, it is indebted to the untiring energy and ability of its conductor, Mr. Francis Speir, jun., of South Orange, N.J.

N. M. B.

THE LONGEVITY OF GREAT MEN.

The conclusion that the intellectual giants of the race are favored by an abundance of years on the scene of their heroic activity, and are thus further differentiated from their more common fellow-men, seems natural, and has been accepted upon evidence which, in a less pleasing conclusion, would be considered ridiculously insufficient, and even false. The usual method of attempting to answer the question whether great men are longer-lived than others, is to prepare a list of the ages, at

death, of a number of eminent men, take the average age, and compare it with a similar average of a number of ordinary men, or even with the average lifetime of the race, and in this way to make the results speak decidedly in favor of the superior longevity of great men. All that such a method can prove (and this it does prove) is that it takes long to become great. It neglects to consider that a select class of men is dealt with, and that, to be even potentially included in this class, one must have lived a certain number of years.

For example: in an article translated in the *Popular science monthly* for May, 1884, it is argued that astronomers are a long-lived race because the average life-period of 1,741 astronomers is 64 years and 3 months. An average human life is only 33 years; but, as one cannot be an astronomer before adult life, the author takes the expectation of life at 18 years, which is 61 years, and thus makes an excess of over 3 years in favor of astronomers. He also divides his astronomers into four degrees of eminence, and finds that those of the first rank live longer than those of the second, and they in turn longer than those of the third, and so on, thus implying that the best astronomers are most favored with years. The true conclusion is, that it takes longer to become a first-rank astronomer than it does to become a less eminent one.[1]

If great men were great from their infancy, and we had the means of ascertaining this fact, the method would be correct. But as it is, we must define in some way or other what we mean by greatness, and then fix the average age at which it becomes possible to distinguish an amount of talent sufficient to enable its possessor to be enrolled in the ranks of the great as already defined. What is known as the 'expectation of life' at any number of years tells the most probable age at death of one who has attained the years under consideration: a comparison of this age with the age at death of great men will decide whether they are longer-lived or not.

The attempt was made to select about 280 to 300 of the greatest men that ever lived.[1] Throwing out about 30 of the doubtful names, there remain 250 men, about whom the statement is hazarded that a list of the 250 greatest men, prepared by another set of persons, will not materially differ from our list, as far as all the purposes for which it is to be used are concerned. From this list I have selected at random a set of men of whom it was probably easy to fix the age at which they had done work which would entitle them to a place on this list, or work which almost inevitably led to such distinction: it is a date about midway between the first important work and the greatest work. The average of over 60 such ages is 37 years; which means, that, on the average, a man must be 37 years old in order to be a candidate for a place on this list. The real question, then, is, How does the longevity of this select class of 37-year-old men compare with that of more ordinary individuals? The answer is given by the expectation of life at 37 years, which is 29 years, making the average age at death 66 years. And this is precisely the age at death of these 60 great men; showing, that, as a class (for these 60 may be considered a fair sample), great men are not distinguished by their longevity from other men.

Further interesting conclusiens can be drawn if we divide the men into classes, according to real psychological and physiological differences in the ways of manifestation of the several kinds of genius. It is almost surprising how well the ordinary trinity of faculties — intellect, emotions, and will — accomplishes this purpose. Greatness seems to appear either in a brilliant thought, a deep feeling, or a powerful will. Under men of thought would be included philosophers, scientists, historians, etc.; under men of feeling, poets, musicians, religionists, etc.; under men of action, rulers, commanders, statesmen, etc. Before comparing the relative longevity of these three classes of men, I assure myself that the period at which greatness begins to be possible does not materially differ[2] in the three classes, and, as was done in the former case, I exclude all cases of unnatural death. I find that men of thought live 69.5 years, or 3.5 years longer than ordinary men; while the lives of men of feeling are 3 years, those of men of action 5 years, shorter than those of average men, — a conclusion that agrees with the commonly

[1] Mr. Galton (*Hereditary genius*, p. 34) has allowed himself to neglect a similar consideration. In giving the number of men in each class that the population of the United Kingdom would have between certain ages, he gives 35 as the number of men of class G (a very high degree of eminence) between the ages 20 and 30, and only 21 such men between 40 and 50 years. But this cannot be true, because only a very small proportion of men could possibly attain the eminence requisite to be classed among the G's in 20 to 30 years, while almost all (of those who will attain it at all) will have attained it before the end of their fiftieth year. And this consideration far outbalances the excess in absolute number of men between the former ages over those between the latter. Similarly the falling-off in the number of men of class *g*, i.e., idiots, from decade to decade, would be more rapid than in ordinary men, — a fact which the tables fail to show.

[1] The names were selected by three others and myself, while engaged in a study of what might be called the natural history of great men. The process of selection was most rigid and careful, by a system which it would take too long to describe.

[2] Mr. Sully (*Nineteenth century*, June, 1886) has shown that men of feeling are more precocious than men of thought; but the difference in the age at which their first great work is done, though in favor of men of feeling, is very slight indeed.

accepted view on the subject. If we subdivide these three classes, we find, that, while all classes of men of thought live longer than ordinary men, the moralists live longest, scientists coming next; that among the men of feeling the religionists alone live the full period of life, while poets' lives are 5 years, and musicians' lives 8 years, too short; that, of men of action, rulers and commanders both fail to complete the full term of life by 4 years. One sees from these statements (which, however, in their detail at least, must be accepted with hesitation, owing to the fewness of examples) that the kind of psychical and physical activity pursued, influences the life-period; that certain types of genius are apt to die young, while others are particularly favored with a full allowance of years.

The question of longevity becomes important when we consider that through it the leaders of civilization are allowed to exercise their important function a few years longer, thus enabling more great men to be alive at the same time; and that, by its tendency to be inherited by the offspring, the children of great men will begin life with a better chance of reaching maturity, and, in turn, of becoming important to the world, if, as we have reason to believe it would, the genius of their ancestors has left its traces in them.

JOSEPH JASTROW.

PARIS LETTER.

THERE is a good deal of discussion going on at present concerning the Municipal laboratory in Paris. This laboratory, as is known, was established in order to furnish to all persons who require them, a means of making careful analyses of all sorts of manufactured goods, and especially eatables and drinks. Of course, this made the dealers and manufacturers who sell impure wine, milk, or preserves very angry. But this resentment showed the usefulness of the laboratory; and notwithstanding the efforts of some aldermen, whose votes are under control of wine-dealers, and whose voices are necessary to them, the laboratory has been kept up, and continues doing useful work. The present discussion concerns salicylic acid, and has brought a howl from the beer-men. The laboratory considers the use of salicylic acid as hurtful, and wishes all manufacturers who use it to be prosecuted. In 1877 a committee appointed to study the matter reported, saying that it is better to forbid the use of salicylic acid in the manufacture of beer. In 1880, another committee, on which were Brouardel and Würtz, reported in a similar manner, considering salicylic acid as a dangerous substance, which is preservative only when used in such large quantities as to render the beer toxic, and proposing that all alimentary substances containing that acid be destroyed, and their sale forbidden. In 1881 a law was enacted, forbidding the use of the acid. This brought such a number of protestations, that in 1883 the question was again brought before a committee composed of Würtz, Pasteur, and others. It reported as the preceding ones had done. It was immediately decided to prosecute all manufacturers of or dealers in alimentary substances containing the acid. But as the victims of the prosecution were generally innocent, being retailers, and not manufacturers, a plan was instituted to seize upon beer as it came into Paris, and before it was sold to dealers. But there arose a serious difficulty. Most of the adulterated beer comes from Germany, and the law has no force among foreigners. But then the dealers to whom German beer is sent have it analyzed; and, if it contains salicylic acid, they merely have to send it back. On the whole, the course followed by the Municipal laboratory is a very good one, and profitable to public health. It will always have enemies, since unscrupulous dealers will always exist, as they have always to the present day; but every man who cares for his health must be a stanch supporter of it.

The *Journal officiel* has recently published the annual report on the statistics of the population of France for 1885. The results are very unsatisfactory. The birth-rate has diminished (it is 922,361), being smaller than usual by twenty or thirty thousand. The number of illegitimate children is larger than in preceding years, being more than eight per cent instead of seven. The death-rate also has diminished, but not to a degree commensurate with the birth-rate, which exceeds the death-rate by 85,464. This difference is much smaller than it was some ten years ago, when it was 140,000 or 150,000 yearly. However, it must be remembered that the effects of the war of 1870 are still felt, and that the diminished birth-rate may be ascribed to the loss of a great number of men, who, at the present time, would have been heads of numerous families.

M. Paul Bert has recently created in Tonquin a scientific society. He wished to imitate Napoleon in Egypt, no doubt, and has given a sister to the Institut d'Egypt. The Bac-ki-ham-lam-vien—such is the name of the new academy of sciences—has for its mission the collecting of materials for the history of Tonquin. Of course, M. P. Bert has created himself president of the academy, and is sole elector. It is he who decides who shall be the members: they must be of Tonquin blood.

Professor Herzen of Lausanne has published an interesting review of the researches recently con-

ducted by two Italian physiologists, concerning the physiological action of the thyroid gland. It is known that the views held by the different investigators are very diverging, and that many are obliged to confess, that, though this gland seems to be connected with blood-corpuscles, the exact relation between the two is quite problematic. MM. Albertoni and Tizzoni, the above-mentioned investigators, believe they have found out the real function of this gland, and, after a careful study of blood in animals deprived of the gland, they have come to the conclusion that it gives to hemiglobin the faculty of absorbing oxygen. The fact is, that the blood of animals which have been deprived of the thyroid gland contains a very small proportion of oxygen. Their arterial blood contains less of this gas than does the venous of healthy ones; and the investigators ascribe the symptoms of acute cachexia strumipriva in dogs to this very considerable diminution of oxygen which always follows upon enucleation of the gland.

M. Trouvé, the well-known electrician, has recently devised ingenious contrivances for surgical diagnostic purposes, in the case of a man who had swallowed a fork and applied for treatment to a surgeon who was afraid of being mystified. But M. Trouvé, much more expert in electrical matters than the surgeon, who understood little or nothing on the subject, and was more than usually ignorant, relieved the scruples of the latter in a very simple manner. He devised a *sonde oesophagienne* connected with an electrical apparatus and a bell, and made in such a manner that contact with a metallic substance allowed the passage of the current, and made the bell ring. The bell was heard very distinctly. In addition, he made some very simple as well as convincing experiments, that the surgeon ought to have thought of. He placed a very sensitive magnetic needle in the vicinity of the patient, and saw the needle turn towards him; he brought a large electro-magnet into the vicinity of the stomach, and, each time the current was on, the fork came towards it, upheaving the skin and muscles of the abdominal walls in a marked manner; and at length the surgeon was convinced, and he performed the operation.

The twins of Locana, who have been shown in almost every town of Europe as the successors of the renowned Siamese twins, are at present dying in Vienna, or at least are very ill. These twins, now aged ten, are united from the sixth rib downwards. They have but one abdomen and a single pair of legs. One of these is under Jacob's control; the other, under that of John. They cannot walk, and cannot easily keep their balance. One is much stronger and healthier than the other, and eats more: it is Jacob, and he keeps his brother alive. Some time ago, both quarrelled over a toy, and John got so excited that he fell into a state of syncope, or trance, from which he did not recover till the next day. He had already had an illness of the same kind, and Virchow of Berlin had prognosticated that a second one would kill him. This Jacob knew well: so, of course, the illness of his brother (an apparently lifeless body) gave him all the more concern, since the death of his brother would but shortly precede his own. The physicians are doing their best to save the unfortunate children. Of course, no operation can be thought of in the present case. Even in that of the Siamese twins, there were great difficulties attending a surgical intervention; and, before it was resolved to intervene, death had already done its work. If the twins recover, they will go to the states, where they were engaged, it is said, at the rate of six thousand dollars per year; if not, their skeleton is already promised to a London anatomical museum for eight thousand pounds.

A schoolmate of M. Marcel Deprez, the able engineer who conducted the experiments related in one of my last letters, concerning the transmission of electric force at great distances, published some days ago an interesting paper on the biography of his friend. M. Deprez was an unsuccessful scholar, who failed to enter the Ecole polytechnique, but was remarkably endowed as to scientific and mathematical pursuits. He was extremely religious, and of a very militant turn of mind. He could never bear discussion; but, when it came to religious matters, he was a fanatic, and would, in the times when the Inquisition flourished, have been an intolerant and dangerous man. Another singular trait of this able and gifted scientist is his hatred for all forms of art. It must be added that M. Deprez's eccentricities have been considerably modified by age.

The French government has decided to greatly extend the department of ballooning for military purposes. There are to be eight aerostatic stations; namely, at Epinal, Toul, Verdun, Belfort, Montpellier, Grenoble, Arras, and Versailles, the principal one being the last named, which is also the only one existing at present. All the military corps will also be shortly provided with the implements necessary for strategic ballooning. No further progress has been made in the art of balloon-managing: the problem is considered solved, and only few improvements, of secondary nature, are needed.

An interesting case of protracted pathological sleep is at present receiving attention in the Sal-

pétrière. It is that of an hysterical woman, who, in consequence of a left-sided hemiplegia, has been in that establishment since 1862, and has remained in bed ever since. This protracted sleep comes on in January generally, sometimes also in July. The patient sleeps for a week or two, or even longer. In January last, Eudoxie Hilouin — such is her name — slept fifty days; in July, only eighteen days. Before falling into this sort of trance, she is very much excited, shouts, and thinks she sees animals of all sorts. During the sleep, her breathing is irregular, alternately calm and regular, then short and rapid. She is insensible to pain, and nothing can wake her. She eats, however, what is given her, and repels substances the taste of which is unpleasant to her. She is fed with liquids most of the time. She is very fat. She weighed 280 pounds (160 kilograms) some time ago, but her weight falls off during the sleeping periods. Before awaking, nervous trembling is perceptible, and she laughs immoderately. She hears during her sleep, as has been shown by a physician who has succeeded in getting her to do various things, in the usual manner.

An often and periodically debated question, which is always arising, like the fabulous Phoenix, is that of *Paris, port de mer* (Paris, a marine port). Its solution is not impossible, and some day next century may see the big steamers of the White Star, or Cunard, or some other line, steam from New York directly into the middle of Paris. However, at present the question is not much advanced, since it rests only on the material feasibility of the canal from the Atlantic to Paris, as it did in the times of Sully and Vauban, who had given much consideration to the matter. The projects are numerous. The first, that of Passement and Billard, in 1760, consisted in increasing the depth of the Seine. In 1790 the Marquis of Crécy proposed a canal going from Paris to Dieppe; but this plan was not a good one, owing to the porous nature of the layers of the soil. In 1860, M. Lebreton proposed a canal one hundred and sixty kilometres long, eighty metres wide, and ten metres deep; but the cost would have been enormous. In 1869, M. Dumont proposed a plan similar to that of the Marquis of Crécy, in which water had to be brought from two rivers, and in which numerous locks were established. Many other plans have been proposed; but the best of all is yet of little use, on account of the expense: it seems to be that of M. Lebreton, as it does not require locks, and there can be no trouble about the water, which will be that of the Channel. Some day or other it may succeed, however, when progress in the mechanic arts shall have lessened the expense.

Dr. Tanner has found in Italy a competitor, Succi by name, who has undertaken a thirty-days' fast. He began the experiment on the 17th of August, and the trial will soon be over. The experiment seems to have been conducted in good faith. A committee of physicians has been appointed to witness the experiment from beginning to end, and the patient has a constant body-guard, relieved twice a night and six times per day, of persons who keep vigilant watch over him, to prevent all fraud. Succi pretends to be able to fast the thirty days, if he is only allowed to drink some water, and some drugs which he has prepared from African plants, — a composition which he keeps a secret as yet. He requires also some tartar-emetic, olive-oil, and anisated water. The first day of the fast he drank some of his drug, and remained in bed, because during the first week he is generally a little indisposed, and requires rest. The ninth day he took a drive, and then a ride, for an hour, without feeling the slightest discomfort. The loss of weight was only five kilograms; muscular energy was unabated, as well as agility. The 1st of September the condition of the patient was very good. He went to a bathing establishment, and swam three-quarters of an hour without any fatigue. He went home on foot. The next day he ran for more than half an hour, at gymnastic pace. His muscular energy was in very good order. Succi is a man forty-five years old, who has travelled a good deal in Africa, and has been thought mad for a time: in fact, he has been shut up in a mad-house in Rome. The herbs from which his liquors are extracted grow in Africa, but are also found in Italy.

Among recent publications, space allows only notice for two. One of them is a little book published by Professor Forel of Lausanne, concerning the Lake of Geneva; Lake Leman, as all the inhabitants of Canton de Vaud call it, having some antipathy to the name of Geneva and to the inhabitants of the town. This book is a very interesting one, and it could be used as a model for similar works. Forel gives details concerning the situation, form, altitude, depth, dimensions, and affluents of the lake; the currents therein; the waves and winds; the chemical analysis of the water, its color, temperature, and singular barometric oscillations (the *seiches*), etc. A good part of the book is devoted to the fauna and flora, and to the prehistoric remains that have been found on its borders. Of course, the facts contained in this book are especially interesting to inhabitants who live in the vicinity of the lake. The plan is a very good one, and may be of use to persons engaged in similar pursuits, concerning some other lake or large body of water.

The other book is a short pamphlet by Dr. U. Perronnet, and treats of mental suggestion. It is a very interesting little work, relating curious facts, and that seems to be appreciated by competent persons. Two works are in preparation on the same subject, — one by Dr. Ochorowitz; the other, by Dr. Baréty of Nice. These two works will be interesting, their authors being especially competent, which is not the case in many others recently published, and of which I prefer not to speak. V.

Paris, Sept. 14.

VIENNA LETTER.

A NEW and very sensitive test for cellulose and vegetable fibres has been described recently by Dr. Hans Molisch, an assistant at Professor Wiesner's phyto-physiological laboratory. It is based on the fact, that, by the action of water and concentrated sulphuric acid, cellulose is converted into sugar, or, to speak more correctly, into dextrine and dextrose: therefore vegetable fibres consisting mainly of cellulose exhibit indirectly the reactions of sugar. The importance of this new test for detecting adulterations of wool, etc., can easily be understood.

An important discovery in reference to cellulose has been made here. It was generally assumed till now that the occurrence of this body was restricted to the vegetable kingdom, and to a few families of invertebrated animals — viz., the Ascidia and Tunicata — containing tunicin, or animal cellulose, in their 'mantle.' Now, Mr. Ernst Freund claims to have found cellulose in the human blood and organs under particular pathological conditions. These conditions are produced by tuberculous disease. Taking into consideration some etiological facts, especially the effect of the quality of food on the spread of tuberculosis among the population, Freund was induced to examine if cellulose may be a chemical substratum for the formation of tuberculous growths. The tuberculous organs (lungs, spleen, miliary tubercles of the peritoneum) and blood, when treated properly, yielded an organic non-nitrogenous body, belonging, as it was proved by ultimate analysis, to the carbo-hydrates, and possessing all the properties of cellulose. In all the cases, — those taken from normal organs, and those afflicted by various non-tuberculous diseases, — Freund failed to find cellulose at all: therefore he feels himself compelled to conclude that cellulose is a typical constituent of tubercles and of the blood in tuberculosis.

The seventh meeting of the International congress of orientalists will be held here from Sept. 27 till Oct. 2. Many illustrious orientalists, especially Indians, will be present, more than three hundred and sixty members being already announced. The principal orientalists' associations will send their delegates. More than forty papers will be read, among them some on ethnological matters. The publication of the so-called 'Fajum papyros' found some years ago in Egypt, being now in possession of the Archduke Rainer, promises to be of great interest.

On Sept. 2 the highest European meteorological observatory was dedicated solemnly. It is situated on the Somblick Mountain (near Rauris, Salzburg), 3,103 metres above the sea-level, and consists of a tower and three other rooms. It is supplied with all the necessary meteorological instruments, and is connected by telephone with the nearest telegraph-office. Herr Rojacher, proprietor of the Rauris mines, has aided the progress of the work in a very munificent manner.

The number of medical students at the Vienna university is rapidly increasing. During the winter session just past, 2,407 ordinary and 266 extraordinary students were there matriculated. The minister of public instruction, therefore, issued a circular to the medical department of Vienna university, asking if the number of students would not have to be restricted by introducing a *numerus clausus*.

As I am now informed, the mantle of Auer von Welsbach's lamp, described already in a previous letter, is prepared by impregnating the gauze with solutions of salts of zirconia, oxides of lanthanum (and yttria). V. C.

Vienna, Sept. 14.

NOTES AND NEWS.

CASES of so-called hydrophobia, in which an interval of years elapses between the bite and the appearance of the disease, are to be regarded with suspicion. Dr. Jardin-Beaumetz, in a communication to the Conseil d'hygiène, gives the interval, or the period of incubation, as it is termed, as averaging between three and four months, in fifty-eight cases of hydrophobia in man, observed since 1881. A well-authenticated case, which is a striking exception to this rule, has recently occurred in France, in which nineteen months elapsed.

— Mr. Arnold Hague, of the U. S. geological survey, who is now in the Yellowstone national park, writes that the accounts which have appeared in various newspapers, of an outbreak of the Excelsior geyser coincident with the date of the recent earthquake that was so destructive at Charleston on Aug. 31, are entirely without foundation. He has been studying this geyser for the last four years,

and is confident, notwithstanding various reports to the contrary, that it has not played during that time.

HOUSE IN LINCOLNVILLE, SHOWING CHIMNEY-BASE CRUSHED BY UPWARD MOVEMENT OF THE EARTH.

SINK AT TEN-MILE HILL AFTER THE GREAT EARTHQUAKE.

— A cable despatch from the Cape of Good Hope through Dr. Krüger at Kiel, Germany, announces the discovery of a comet at the cape by Professor Finlay on the 26th of September. Its position was, Sept. 26d. 8h. 3m., Greenwich mean time; right ascension, 17h. 2m. 5.9s.; declination, — 26° 4′ 6″. Its daily motion was in the direction of increasing right ascension 2m. 20s., and toward the south 4′. It is described as circular, one minute of arc in

diameter, with some central condensation, and is very faint.

— A company in this city is endeavoring to perfect a process for the desiccation of garbage, with a view to utilizing the vast quantity of city refuse now dumped in the sea from garbage-scows. The matter to be treated is run through a shoot into one end of a revolving cylindrical oven about sixty feet long by ten or twelve feet in diameter. The oven, which is strongly constructed of boiler iron, is enclosed in a brick furnace, one end being higher than the other. A fire in the furnace keeps an equable heat in the oven, and the latter is slowly revolved by a steam-engine. The garbage or refuse enters at the elevated end, is thoroughly stirred and dried as it slowly travels from one end to the other of the revolving oven, and emerges from its lower end desiccated and inoffensive.

— Though there is nothing novel in the propulsion of boats by means of electric motors, the recent voyage of the electric launch Volta across the English Channel, from Dover to Calais and back, has attracted much attention. Many electrically propelled boats, deriving their motive power from primary or secondary batteries, have been experimented with by electricians; but heretofore these experiments have been confined to rivers or other bodies of comparatively smooth water. The honor of having made the first sea-voyage — brief though that voyage was — must be accorded Mr. A. Reckenzaun of London. Accompanied by nine other gentlemen, Mr. Reckenzaun left Dover at 10.40 A.M., Monday, Sept. 13, in the Volta, and reached Calais at 2.32 P.M. On the return trip, the party left Calais at 3.14, and arrived at Dover at 7.27. Taking into account the drift due to the tide, the total distance travelled was about fifty-four statute miles, the total running time being a few minutes over eight hours. The Volta is 37 feet long by 6 feet 10 inches beam, and is built of steel. The secondary battery, of sixty-one cells, weighing about four thousand pounds, was arranged along the bottom of the boat. The propellor is three-bladed, 20 inches in diameter, and 11 inches pitch, and was driven at a maximum speed of one thousand revolutions per minute by a duplex Reckenzaun motor, or, more accurately, two motors carried on one shaft. The motors weigh between seven and eight hundred pounds, and develop a maximum of sixteen horse-power.

— Large floating fields of pumice, thrown up by the great volcanic eruption at Krakatoa, Java, have been seen in the Indian Ocean, nearly seven hundred miles from where they were seen a year ago.

— Dr. Miller of Austria has been making some extremely valuable observations on the action of the stomach upon fungi. Inasmuch as one of the common methods by which zymotic diseases are believed to be produced is by the introduction of their germs into the alimentary canal, it can readily be seen that this investigation is replete with interest and importance. He finds that if these fungi, as, for instance, bacilli and bacteria, are introduced at the beginning of the meal, before the hydrochloric acid of the gastric juice is poured out by the stomach glands, they pass on to the intestine uninjured. If, however, they are taken into the stomach at a later time, when the reaction of the stomach is acid, they are destroyed. It has been satisfactorily demonstrated by numerous observations that persons were more likely to contract cholera when the stomach was diseased, or, as is commonly said, 'out of order.'

— We give this week two more illustrations showing the effects of the great earthquake. One is of a 'sink' at Ten-Mile Hill. These sinks were, in general, after-effects, being formed, as Professor McGee pointed out in the last number of *Science*, after the subsidence of the floods of water which came from the 'craterlets.' The other illustration shows a fallen house at Lincolnville. This is chiefly of interest as showing how, by a probable upward thrust of the earth, the base of the chimney, which offered the most resistance, was completely crushed.

— Dr. Charles L. Dana discusses in the *Forum* the question, 'Is life worth saving?' He places the value of an adult life to the state at at least $750, and its annual productive power at $95. One-half of all the deaths occur during the productive age, so that the two hundred thousand deaths at this period, which occur annually in the United States, represent an enormous loss to the country. It is also calculated that every death represents about two years of sickness, and that there are in this country about a million and a half persons sick all the time. In England and Wales it has been found that every workingman averages a week and a half of sickness in the year. It is estimated that the wage-loss from sickness in France is $70,000,000 each year, and from death $188,000,000.

— Mr. Mackellar, chief surgeon to the London police, has issued the following directions to the surgeons of divisions, for their guidance in treating persons bitten by rabid dogs: "When possible, a ligature to be applied above the part bitten; prompt and thorough suction of the wound, freely washing with water, and the application of absolute phenol (pure carbolic acid); the individual

sucking the wound (usually the patient himself) to spit out all the matter so sucked, and to freely wash out the mouth with water; should the wound be a punctured wound, make a crucial incision, promote and encourage bleeding, and treat as above." Mr. Mackellar condemns the use of nitrate of silver, and says the pain caused by the phenol is of short duration.

— *La nature* recommends the following method of cutting thick glass tubes: wind an iron wire half a millimetre in thickness around the glass tube, and connect it with a galvanic battery of sufficient power to raise the wire to a red heat; then put a few drops of water near the wire upon the glass; the latter will then crack in the direction of the wire, and, the thicker the glass, the more exact will be the fracture.

— Ten thousand cases of cholera occurred in Japan during the first six months of this year, of which 7,803 were fatal. During the preceding six months, 12,000 cases occurred, with 7,152 deaths. The disease is now prevailing in Osaka and Yokohama, the mortality varying from sixty to seventy-five per cent.

— The monthly bulletin published by the New York state board of health contains the following vital statistics: the reported mortality throughout the state during the month of June was 6,336, of which 35.3 per cent were under five years of age; 1,220 deaths were due to zymotic diseases, or 193.65 in 1,000 total mortality; the ratio per 1,000, of deaths from typhoid-fever, was 6.20; from diarrhoeal diseases, 73.80; from croup and diphtheria, 60.32; from consumption, 144.60.

— The examination and criticism of the last annual report of President Eliot of Harvard, that Prof. Andrew F. West of Princeton published in the *Independent*, has been issued in pamphlet form. It is chiefly devoted to refuting President Eliot's arguments in favor of the elective system as practised at Harvard.

— The collection of *Mémoires et documents scolaires publiés par le Musée pédagogique*, under the auspices of the department of public instruction in France, is to be enriched by a learned and curious *Répertoire des ouvrages pédagogiques du xvi^e siecle.*

— The *Journal des économistes* has been publishing articles describing the principal economic publications of the world. In a recent issue, M. Maurice Block, member of the institute, reviewed the publications other than French, and gave a most flattering notice of the *Political science quarterly* recently started by the faculty of the school of political science, Columbia college.

— Where accuracy is desired in the measurement of liquids, 'spoons' and 'drops' should be discarded. The ordinary teaspoon, which is presumed to hold a dram or sixty minims, in reality holds eighty, and can with a little care be made to hold one hundred and twenty minims, or twice what is ordinarily attributed to it. A drop is also a very indefinite quantity, — a fact of which any one can satisfy himself by dropping an equal number of drops of molasses and alcohol into a measure of known capacity, and comparing the amounts. The size of the drop is also materially affected by the vessel from which it is dropped. The 'minim' is a definite quantity, sixty of these making a dram, and should always be used, especially in dispensing medicine.

— The *Journal of reconstruction* states that an infant loses from three to six ounces in weight during the first four to six days after birth; by the seventh day it should have regained its birth-weight; from that to the fifth month it ought to gain about five ounces per week, or about six drams a day; after the fifth month, about four drams a day; at the fifth month it ought to have doubled its birth-weight, and in sixteen months quadrupled it.

— Carl Meyers made from the fair-grounds in Franklin, Penn., on Wednesday, Sept. 8, the first ascension known with natural gas, the balloon rising just one mile, and sailing about one hour.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Psychophysics.

Mr. Hyslop, in his article on 'Psychophysics' in *Science* for Sept. 17, charges the writers on that subject with laying claim to a scientific accuracy which they do not possess. Any such charge as this manifests so plainly a misconception of what psychophysics really professes and attempts, that a word of defence seems to be in place. The conclusion was drawn from the alleged incorrectness of Fechner's mathematical statement of the psychophysic law. From some admissions of M. Ribot regarding the same, Mr. Hyslop concludes that "such admissions prove fatal to any such exactness as is enjoyed by the physical sciences." Aside from the question of the truth or falsity of Fechner's statement of the law (Mr. Hyslop queerly admits that it is true), let it be observed that psychophysics, so far from professing to be a mathematical science, does not profess to be a science at all; but it does modestly claim to pursue a scientific method. This method, which, as Wundt explains, is peculiar to the physical sciences, is the experimental method. It does not differ from the old psychology, as Mr. Hyslop thinks, so much in having discarded introspection. Any psychology, even physiological psychology, must, by the nature of the case, be introspective. It differs fundamentally in this: that whereas the old psychology assumed the

dictata of *consciousness* to be the whole sphere of psychology, started with these and reasoned out a complete so-called science, the new psychology modestly starts with physiological experiments, and records the psychological results. It works from without inward. It begins with external conditions which it can control, and, by subjecting these to as exact and accurate measurements as are known in modern science, it observes the corresponding mental phenomena. We can conceive of almost any other criticism being brought against psychophysics than that it is unscientific or inaccurate. Whether it is a fruitful study, or has thus far repaid the immense labor expended upon it, may be questioned; but that it is characterized by the most patient research, the most precise measurements, the most cautious conclusions, and a scientific spirit that the old psychology never approached, cannot be reasonably denied.

As regards the psychophysic law of Weber, under the following statement it has been generally accepted, and found useful and suggestive: "The difference between two excitations, must, in order that the differences in sensation be equally appreciable, grow proportionally to the magnitude of the excitations." The mathematical statement of the same by Fechner — "The sensation grows as the logarithm of the excitation" — has given rise to the question whether differences in sensations can be expressed in terms of quantitative measurements. This objection is urged by Zeller, and rejected by Wundt. It implies the old error of a physical world without, and a spiritual world within, which have nothing in common. While Wundt's position here is theoretically correct, the question may nevertheless be raised, whether, ultimately, differences in sensations are not qualitative rather than quantitative differences.

GEO. T. WHITE.

Science for a livelihood.

I have just read the communications of C. B. of New York and W. F. Flint of New Hampshire in Nos. 188 and 189 of *Science*, under the above heading, in which there is a strain of lament over the frugal table which the field of science has spread for ambitious young men who desire to live, or at least exist, on a purely scientific diet. As I deem the subject of vital interest to nearly every young man with scientific tendencies about to choose a profession, I desire to add a few words.

'I graduated in the spring of 1884 from a scientific department of the Kansas state university. After taking a pretty thorough general course of study as an undergraduate, I finished my work by spending two years in the Natural history laboratory, under the direction of Prof. F. H. Snow. If I did not receive a 'good' or 'first-rate scientific education,' I did, at least, master a few principles, and laid a foundation for future work and study. During my last year in the laboratory, I had the refusal of two positions as teacher of natural history, both of which paid good living salaries. Within a year's time after graduation, I was offered three positions, with no salary less than twelve hundred dollars. Meanwhile I had not made a single application for a position.

George F. Gaumer, Annie E. Mozley, and Richard Foster graduated from the same department while I was in the lower classes, and all three have held good positions. Gaumer went to Cuba, then to Yucatan, and afterwards to various parts of Central America. On his return, after an absence of three years, he reported fine success, particularly in a financial way. He cleared twenty-five hundred dollars by selling specimens of the golden turkey, and increased his finances in various ways as a collecting naturalist. But this was only a small part of his success. He collected many rare birds and insects, some of which were new to science, and returned with a reputation as a rising young naturalist, to receive an appointment as professor of natural history in the University of Santa Fé, New Mexico. Richard Foster speaks for himself as professor of natural history in Howard university, Washington, D.C.

W. C. Stevens graduated from the natural history department in 1885, and immediately received a good position as a teacher of natural history. J. D. McLaren graduated from the same department with the class of '86, and in less than a month's time his scientific training secured him a position as teacher at a hundred and fifteen dollars per month. W. H. Brown, member of the senior class, who has spent but a single year in the department, went to the Smithsonian institute to spend a month of his summer vacation, and learn what he could by observation, expecting to return, however, and resume his work in the laboratory. But, alas! news soon came that his enthusiasm and skill had secured him a good place with increasing wages.

As much, if not more, might be said of the students of the other scientific departments of the university. All the graduates from the 'course in chemistry and physics' are professors enjoying enviable positions as well as good salaries. Many of the advanced undergraduate students from this course hold respectable positions, and receive good wages.

I must be brief as possible, but not so brief as to omit the civil engineering department, the graduates of which receive larger salaries, perhaps, than those laboring in other scientific fields. The most surprising thing about this department is, that there is such a present demand for the young men, that nearly all of them are called into the field to hold responsible positions, and receive remunerative wages before they have finished their work in the department.

As regards the 'wealth' and 'friends' of the young men of whom I have spoken, allow me to say that all of the graduates, with a possible single exception, were farmer boys who earned with their own hands most if not all the money which kept them at the university. And the only 'friends' they had 'to forward them in their chosen fields' were those which industry and good progress won for them in those fields.

I think the facts will bear me out in saying that no class of Kansas young men are doing better, or have more brilliant prospects, than those which have done good work in the scientific departments of the university.

L. L. DYCHE.

Lawrence, Kan., Sept. 20.

Photography of the solar corona.

Accounts have appeared in your journal, of my attempts to photograph the corona of the sun without an eclipse. Many of the plates obtained presented appearances which, not to myself only, but to several scientific men who must certainly be considered to be among those who are exceptionally competent to give an opinion on this point, seemed to be most probably due to the corona. Plates taken in England about

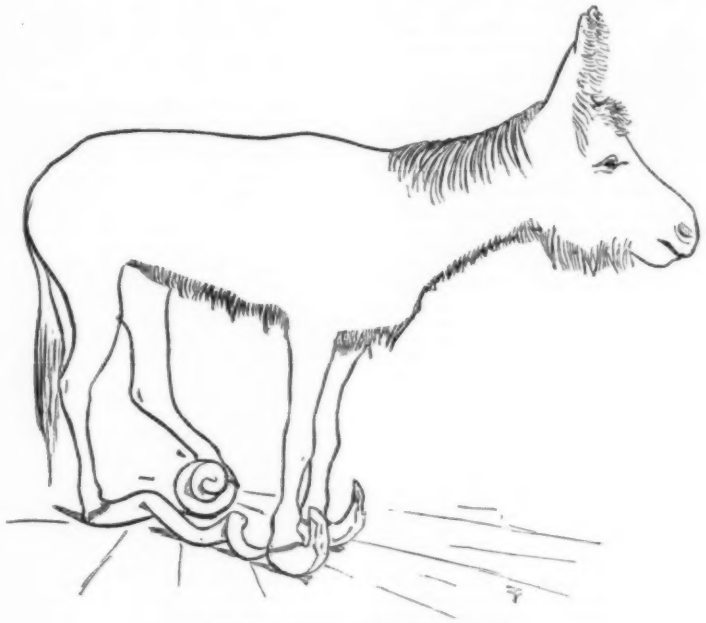
the time of the eclipse of May 6, 1883, and drawn by Mr. Wesley before any information reached this country of the observations of the eclipse, presented not only a general resemblance to those taken during the eclipse, but showed the remarkably formed rift on the east of the sun's north pole, which is the main feature of the corona as photographed at Caroline Island. It is true that since the summer of 1883 I have not been able to obtain in England photographs which show satisfactory indications of the corona; but the abnormally large amount of air-glare from finely divided matter of some sort, which has been present in the higher regions of the air since the autumn of 1883, might well be considered a sufficient cause of the want of success. This well-known state of the sky rendered the plates taken by Mr. Ray Woods in Switzerland in the summer of 1884 inconclusive as to the success of the method. During the past year, photographs of the sun have been taken at the Cape of Good Hope, and are under discussion by Dr. Gill.

Such was the state of things before the eclipse of Aug. 29. The partial phases of this eclipse furnished conditions which would put the success of the method beyond doubt if the plates showed the corona cut off partially by the moon during its approach to and passage over the sun. As the telegrams received from Grenada, and a telegram I have received this day from Dr. Gill at the Cape of Good Hope, state that this partial cutting-off of the corona by the moon is not shown upon the plates, I wish to be the first to make known this untoward result. I regret greatly that a method which seemed to promise so much new knowledge of the corona, which, under ordinary circumstances of observation, shows itself only during total eclipses, would seem to have failed. At the same time I am not able to offer any sufficient explanation of the early favorable results to which I have referred briefly in the opening sentences of this letter.

Of course, the above statements leave untouched the criticisms I felt called upon to make on the imperfect methods employed by Professor Pickering.

WILLIAM HUGGINS.

Upper Tulse Hill, London S. W., Sept. 11.



AN ASS WITH ABNORMALLY DEVELOPED HOOFS.

An ass with abnormally developed hoofs.

A pair of very abnormal hoofs has been recently received by the Smithsonian institution from J. C. Baldwin, Esq., of Houston, Tex. They are the hind hoofs of an ass reported to have been bred at San-Antonio, Tex., and which was exhibited in Chicago and other cities of the union.

The right hoof is twenty-six inches in length, and is spirally twisted, like the horn of an Indian goat. The left hoof is in the form of a helix.

The front hoofs were not received, but, from the photograph which accompanied the hind pair, it appears that they were also abnormal.

The animal, as it appears in the photograph, is greatly emaciated. The neck and shoulders are clad with rather long, curled hair, while on the posterior half of the body the hair is short and smooth.

F. W. TRUE.

U. S. nat. mus., Sept. 27.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Sept. 14. — Miss Helen D. Abbott read a paper on chemical constituents of plants with relation to their organic forms. Plants containing saponine, vegetable waxes, and camphors had been examined with a view to supporting the theory advanced, but those only containing saponine were the subject of the communication to the society. Heckel's tables, illustrating the evolution of plants, were used to indicate the relationship of those under consideration, and it was found that the species containing saponine belongs to his middle plane. The compound referred to is always a constructive and formative element of the plant containing it, while its action on other elements probably contributes to the nutrition of the species. It is absent where the floral elements are simple, and it decreases as the plants approach their fullest development, being found in the largest degree in the intermediate groups. Other substances are dominant in plants with flowers simpler or more complex than those in the saponine group. The investigation, as far as it has been carried, indicates that a similarity of one or more chemical constituents is to be found in all plants which are equally developed and on the same evolutionary plane. The evolution of chemical constituents is in parallel lines with the evolutionary course of plant-forms, the one being intimately connected with the other; and consequently chemical constituents are indicative of the height of the scale of progression, and are essentially fit for a basis of botanical classification: in other words, the theory of evolution in plant-life is best illustrated by the chemical constituents of vegetable forms. Attention was also called by Miss Abbott to two new substances obtained by her from a Honduras plant which had not yet been botanically determined, one of which was a camphor. A new dye, chichipatin, was also described. —— Dr. D. G. Brinton called attention to a discovery recently made in the cavern of Spy, near Namur, Belgium, of two human skeletons associated with rough stone implements characteristic of a period near the middle of the stone age. The skulls were related to those of Neanderthal and the cavern of La Naulette, and distinctly suggested a simian relationship. —— Professor Heilprin exhibited the tooth of a mammoth from a point in Florida farther south than any as yet associated with that animal. —— Dr. Leidy remarked that the mammoth was undoubtedly at one time distributed over the entire extent of North America, from the arctic region, through Mexico, and into Central America. —— As an illustration of the occasional longevity, under favorable circumstances, of species which are supposed to be short-lived, the Rev. Dr. McCook stated that a specimen of Tarantula, which was probably a year old when it came into his possession in 1882, was recently found to be alive and well, although now perhaps six years old. It had been supplied with water constantly, but it had not received food from October last until June of the present year. In this connection, reference was made to the queen of Sir John Lubbock's colony of ants. In 1882 it had reached the age of seven years, and was, he believed, still alive. —— Dr. Leidy exhibited a series of negatives of instantaneous photographs of lions in motion, by Muybridge. He had been struck with the fact that the animals are represented as being spotted, distinctly in the male, less so in the female, although such spots could not be seen on the animals themselves, without, at all events, very close observation. He had been informed that photography frequently revealed characters which could not be detected by the eye.

June 21. — Dr. Nolan read an interesting communication recently received from Miss Adele M. Fielde, giving an account of the practice of spiritism by the women of Swatow, China. In the eighth month of the year they meet privately, and fall into trances. Nearly all the native women are interested in these secret sessions; but many are prevented from being present by necessary occupations elsewhere, or by fear of rebuke from the men of their households. These conclaves are entered by women alone, and are regarded by men with great disfavor. From three to a dozen or more women gather around a table in the centre of a room where they can be secure from interruption. Incense-sticks, spirit-money, and bamboo-roots, bought by a previous contribution of farthings, are distributed among all present. A fetish of some sort, a decayed splint hat, an old broom, a chopstick, or possibly a more uncleanly object, taken from a rubbish heap, is brought in, and spirit-money is burned before it, with obeisances. Then those who desire to fall into trance sit down at the table, throw a black cloth over the head, hold a sheet of spirit-money and a lighted incense-stick between the palms before the face, shut the eyes, and remain motionless and silent. Of the other women, some light incense-sticks and whirl them around the heads of the sitters; some rap constantly, gently and rapidly, with the bamboo-roots on the edge of the table; some chant invocations, petitioning the gods to admit these their children to their abode. Many and diverse incantations are iterated. Two or three of the women, perhaps, fall into trance. Their doing so is indicated by their trembling violently, dropping the incense-sticks they were holding, beginning to beat the table with the palms of their hands and to discourse incoherently. They speak of meeting their own lost friends, or those of other women who are present. They weep bitterly while they appear to converse with the dead. They describe streets, shops, and houses, and say that certain persons are engaged in agriculture or trade. Sometimes they, by request, make inquiry concerning the whereabouts of a dead person, and then give the information that he has been born into the human family for the second time. Sometimes they report that a dead neighbor is shut up in Hades, with nothing to eat but the salted flesh of the infant daughters she destroyed when she was alive. As no pecuniary benefit accrues, directly or indirectly, to the actors in these scenes, there is less reason for suspecting conscious deception than in the case of the public interpreters of the gods. Throughout the whole, however, there is an indication that the minds of the women are, during these trances, moving in customary grooves. They evidently see what they expect to see. They bring back no ideas save those which they took with them when starting on their quest; and this leads one to doubt, in spite of their dishevelled hair, pallor, and exhaustion, whether they have, after all, really been away from home. —— Mr. Charles Morris called the attention of the academy to the rapid increase of poison ivy in Fairmount park, especially in the more frequented sections and

in the places much resorted to by children. A few weeks ago a friend who was entirely familiar with the plant was seriously poisoned, in spite of all his precautions to avoid it. The speaker urged the necessity of the park commissioners taking active means of eradicating the pest. This could probably only be done by rooting up the plants wherever they appear. It might be well to plant in their place the Virginia creeper, itself a vigorous and persistent species. —— The death of Mr. William P. Jenks was announced. He was a member of the Board of trustees of the building fund. He was not only a liberal contributor to the fund, but was also one of the most active in soliciting subscriptions thereto while the present building was in process of erection.

Calendar of Societies.

Brookville society of natural history, Brookville, Ind.

Sept. 4. — O. M. Meyncke, Orchids ; A. W. Butler, Buffalo meeting of the American association for the advancement of science ; R. M. King, The scientific works of Baron Cuvier ; J. F. McKee, Some so-called insectivorous birds.

Publications received at Editor's Office, Sept. 13-25.

Benjamin, P. The age of electricity from amber-soul to telephone. New York, *Scribner*, 1886. 8+381 p., illustr. 12°. $2.

Clarke, F. W., and others. Work done in the division of chemistry and physics in 1884-85. (U. S. geol. surv., bull. No. 27.) Washington, *Government*, 1886. 80 p. 8°.

Crehore, J. D. Mechanics of the girder: a treatise on bridges and roofs. New York, *Wiley*, 1886. 14+575 p., illustr. 8°. $5.

Crowninshield, F. Mural painting. Boston, *Tickner*, 1887. 155 p., 13 pl., illustr. 12°. $3.

Ely, R. T. The labor movement in America. New York, *Crowell*, 1886. 16+373 p. 12°. $1.50.

Hartshorne, H. 1931: a glance at the twentieth century. Philadelphia, *Claxton*, 1881. 64 p. 24°.

Morse, E. S. Ancient and modern methods of arrow-release. Salem, *Bull. Essex inst.*, [1886.] 56 p., illustr. 8°.

Smith, S. I. Report on the decapod crustacea of the Albatross dredgings off the east coast of the United States during the summer and autumn of 1884. Washington, *Government*, 1886. 101 p., 20 pl. 8°.

Todd, D. P. First quinquennial report of the director of Amherst college observatory, 1881-85. Amherst, Mass., *The author*, [1886.] [6] p. 8°.

U. S. geological survey, topographical maps of portions of Virginia, North Carolina, Tennessee, Nevada, and California. 42 by 50.5 cm. Washington, *Government*, 1886.

Wachsmuth, C., and **Springer,** F. Revision of the Palaeocrinoidea. Part iii.: Discussion of the classification and relations of the brachiate crinoids, and conclusion of the generic descriptions. (Proc. Acad. nat. sc., March 30, 1886.) Philadelphia, *W. P. Kildare, pr.*, 1886. [195] p. 8°.

White, C. A. Fresh-water invertebrates of the North American Jurassic. (U. S. geol. surv., bull. No. 29.) Washington, *Government*, 1886. 41 p., 4 pl. 8°.

Williams, E. H., jun. A manual of lithology. New York, *Wiley*, 1886. 8+135 p. 24°. $1.25.

Advertised Books of Reference.

SCIENCE.—SUPPLEMENT.

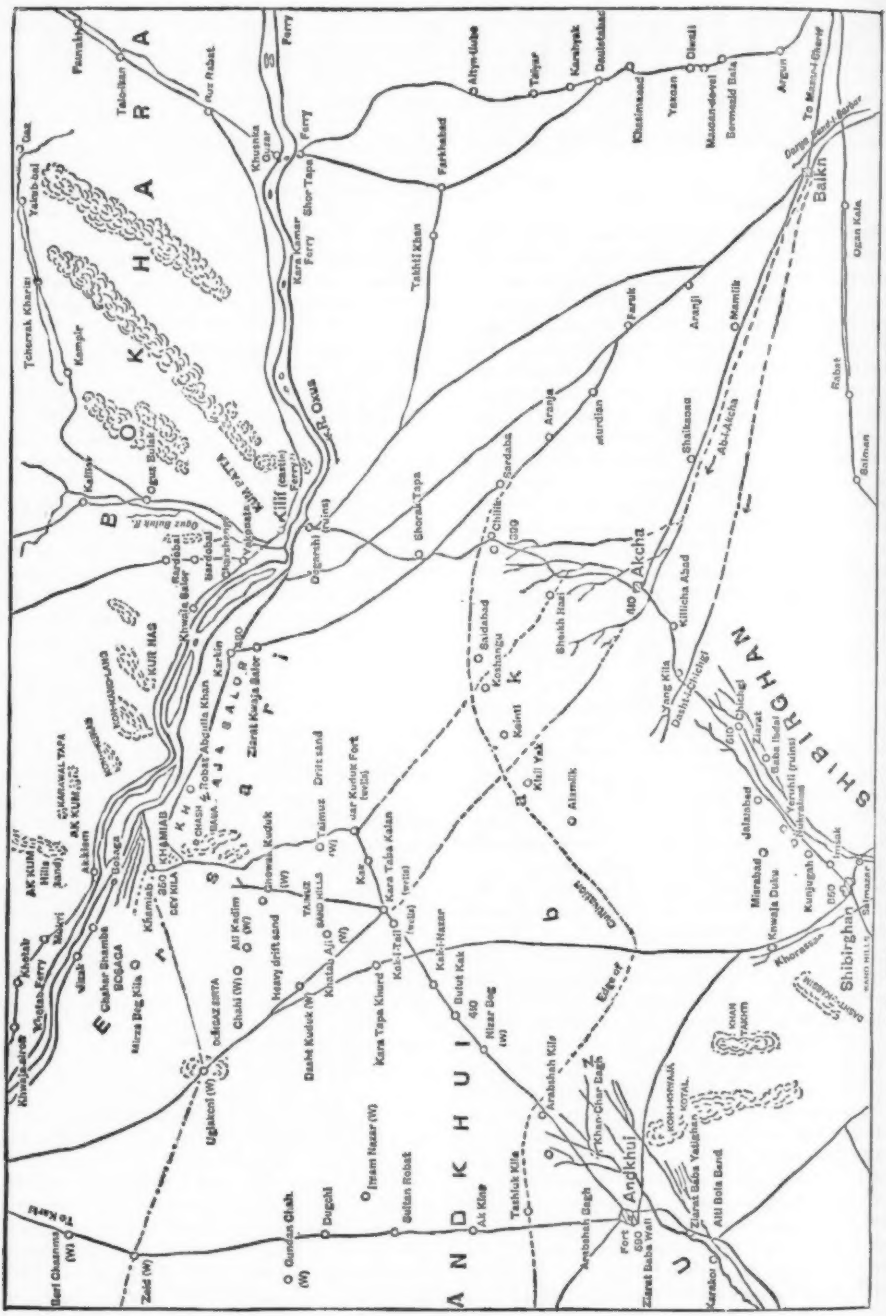
FRIDAY, OCTOBER 1, 1886.

KHAM-I-AB.

THE accompanying map from the London *Times* of Sept. 3 gives with the greatest attainable accuracy, as it contains the most recent surveys of the engineers attached to the English commission, the relative positions of all the places of importance in the last part of the Afghan frontier. The frontier has been absolutely laid down and marked with pillars as far as Dukchi, which is forty miles from the Oxus; and, as a general statement, the reader may accept the fact that Afghanistan retains pasturages of from fifteen to twenty miles north of the road from Meruchak to this place. Andkoi and Kerki on the west, Mazar-i-Sherif, and Chushka Guzar ferry on the east, form the four limiting points of the tract of Afghan territory which is of importance in connection with the final stage of the Afghan frontier question. The district of still more immediate importance is the forty miles separating Dukchi from the Oxus. It is here that the commissioners have been unable to come to an agreement on the spot, and that the governments of England and Russia must devise some means of reconciling conflicting views so that the frontier delimitations may be brought to a clear end. The government of Russia has employed, during the recent exchanges of opinion, the most conciliatory language, and there does not seem at present any reason why the negotiation should not, after all, terminate in an amicable manner. At all events, it is a question calling, in the interests of both countries, for calm consideration and delicate handling.

Since the British commission has been on the Afghan frontier, — and this, we may remind our readers, has been since November, 1884, — it has been found that the existing frontier of Afghanistan and Bokhara on the Oxus, and the one recognized by the tribes and chiefs on the spot, lies between the border districts of Kham-i-Ab and Bosaga respectively. English officers discovered that in 1873 or thereabouts the local officials of Afghanistan and Bokhara actually marked out this boundary. No place of the name of Khoja Saleh was found to exist; but the tract of country from the shrine of the Saint, called Ziarat-i-Kwaja Salor, down the river to Kham-i-Ab, or for a distance of twenty-five miles in all, was known to the Afghans as Khwaja Salor, or Khoja Saleh. It is thus marked on the map. The district is of some fertility, and forms a subdivision of the Akcha governorship, to which it has belonged for nearly a century. It is appropriate to observe that by the 1873 agreement, which has been so much referred to as the basis of the present negotiations, Akcha was declared part and parcel of the dominions of Afghanistan. The district of Khoja Saleh is inhabited by Karkins as well as Ersaris. The former are not Turcomans; and the latter, who reside in Akcha and other Afghan towns, as well as along the Oxus, are not nomads, although Turcomans. They have been cultivators of the soil for a very long time past, and have paid their taxes regularly, and given no trouble to the Afghans.

The confusion which has arisen with regard to Khoja Saleh must, no doubt, be attributed to the account given by Sir Alexander Burnes of his passage of the Oxus at this place. No subsequent traveller has visited this particular point on the Oxus (Vambéry crossed at Kerki; and the Russian envoys to Afghanistan, at either Kilif or Chushka), and the hasty impressions of the English traveller have guided geographers ever since. We have no knowledge of what reports the captains of the Russian vessels, which began to ascend the river as high as Kilif in 1879, may have sent in as to where they first came into touch with Afghan authority, and this would be a point about which the English government might usefully institute some inquiries; but it is encouraging to know that that government has something to say in reply to the demand that the frontier should be laid down in rigid accordance with the terms of the protocol which repeated the phrase of Khoja Saleh employed in 1884 at the time of the formation of the commission, as well as during the negotiations of 1872-73. Accompanying the protocol a Blue-book (Central Asia, No. 3, 1885), containing certain maps, was published, and among these was an extract from the Russian staff map of Afghanistan. This map was intended for the guidance of the commissioners; and a zone of investigation, as well as a line of a proposed frontier, was marked on it. Kham-i-Ab is not mentioned on this map, but the point marked 'Khodsha-Salor' on it corresponds as nearly as possible in latitude and longitude with the Kham-i-Ab of the Afghans. Thus it is a fair contention that the Khoja Saleh of the protocol and agreement of 1873 should be taken as indicating



MAP SHOWING THE DISPUTED AFGHAN FRONTIER AND THE NEIGHBORING REGION.

a point on the Oxus corresponding to the western limit of the district called Khoja Saleh, and that, as the Afghans possessed this tract at the time of the earlier agreement, they should be allowed to retain it. This would, moreover, be in strict accordance with the principle laid down on that occasion; viz., that Afghanistan should be considered identical with the actual possessions of the Ameer Shere Ali.

To sum up the points presented by the Kham-i-Ab question, Russia has in her favor the specific mention of the name Khoja Saleh in the diplomatic documents. Beyond this fact, strong as it undoubtedly is, Russia does not seem to possess a weighty argument. On the other hand, there is the Afghan right of possession, unquestioned by anybody, going back for a long period, and confirmed in 1873. There is the recognition in 1873 of the Khanate of Akcha forming part of the dominions of Shere Ali, and consequently of Afghanistan. Finally, there is the practical fact that the Kham-i-Ab of the Afghans occupies almost the identical geographical site of the 'Khodsha Salor' of the Russians. Extraneous arguments may be easily introduced into the case by irresponsible writers; but these are really all the considerations that need affect the judgment of the two governments.

MAP SHOWING THE DISPUTED AFGHAN FRONTIER AND THE NEIGHBORING REGION.

PACIFIC COAST WEATHER.

LIEUT. W. A. GLASSFORD, in charge of the Pacific coast division of the signal service at San Francisco, has lately presented a paper to the California academy of sciences on 'Weather types on the Pacific coast.' These types differ from those of the eastern United States in their relative lack of progressive motion, and consequently in their duration and in the less variability of the weather. Distinct areas of low pressure are rare in southern California, but increase in frequency northward, until they are most numerous about Vancouver's Island. The types recognized for the rainy season (winter) are, 1°, North Pacific cyclonic; low pressure over Oregon and Washington, high pressure in the Great Basin, with southerly gales along the coast, and general rains, heaviest in the north; 2°, interior anticyclonic; like the preceding, but with less distinct cyclonic conditions; the temperature is high with south-easterly winds; the warm 'Santa Anna' winds of Los Angeles occur under this distribution of pressures; 3°, North Pacific anticyclonic; high pressure in the north, and low in the south, giving clear weather with light, variable winds in the north, but with high winds and southerly gales on the coast of California; warm days and cool nights, often frosty; the dreaded dry 'north wind' of the Sacremento and San Joaquin valley prevails at this time: 4°, general cyclonic; a rare type, with very low pressure on the coast, giving severe storms of high southerly winds and heavy rain; 5°, South Pacific anticyclonic; moderately high pressure along the south-western coast of California, and no distinct centre of low pressure visible, but giving southerly rain-bearing winds; 6°, sub-normal type; irregular isobars and no decided gradients, with variable winds and weather. During the dry season (summer), the weather is very constant, with high pressure to the north-west over the cool ocean, and low pressure over the hot land to the south-east, northerly winds and no rain. The change from the wet season to the dry is indicated when the air temperature on the coast rises permanently over the ocean temperature. Lieutenant Glassford has also compiled an extended table of the rainfall on the Pacific coast from all sources, including some two hundred stations with records varying from one or two years up to thirty-seven (San Francisco and Sacramento). This was published in the San Francisco daily *Commercial news* for July 1, 1886. The maximum precipitation is given for Neah Bay, Washington Territory, where the annual average of nine years' record is 110 12 inches. Many other stations in the north exceed fifty and sixty inches a year. In the south, the minimum falls nearly to two inches, being 2.56 at Yuma, Arizona, from an eleven-year record. The lowest of all is a three-years' average for Bishop Creek, Cal., where the annual precipitation is only 1.31 inches. The table gives the months separately, as well as the yearly total, so that the seasonal variation is well brought out. In July and August only nine and ten stations respectively have over an inch of rain, and these are all in the north or in the interior; while no rain at all is given for eighty-two and ninety stations, and a number more have only a trace or one or two hundredths of an inch.

DR. ROMANES ON PHYSIOLOGICAL SELECTION.

DR. GEORGE J. ROMANES, who, in more than a literal sense, may be said to be the legatee of Darwin, publishes in *Nature* (Aug. 5, 12, 19) an abstract of a paper read before the Linnean society, entitled "Physiological selection: an additional suggestion on the origin of species."

The necessity of such an additional principle is made evident by considering three objections to natural selection as a theory of the origin of species. 1°. The difference between species and varieties in respect of mutual fertility. It is a fact

that many domesticated varieties, though differing from one another to a greater extent than many natural species, retain a perfect fertility among themselves. The consideration that sterility between natural species is not absolute, slightly changes but does not solve the problem. Mr. Darwin admitted the difficulty, and suggested the improbable hypothesis that the sterility was the incidental effect of uniform conditions of life on the generative system. 2°. The swamping effects of free intercrossing upon any individual variation would more than outweigh the action of natural selection; and to answer as Mr. Darwin does, that many individuals might simultaneously undergo the same modification, is to appeal to a highly improbable series of events, especially when it is remembered that, 3°, these specific distinctions are so often of a useless character. Mr. Darwin frankly admitted that many of these meaningless detailed distinctions, like the general distinction of sterility, were not explained by natural selection.

In view of these objections, Dr. Romanes thinks that the theory of natural selection has been misnamed. It is at once a different and a much broader theory, — different, because it explains the origin, not of species, but of adaptations of all kinds, morphological, physiological, and psychological; broader, because it accounts for these adaptations, whether they occur in species only, or also in genera, families, orders, or classes. To realize, on the one hand, that natural selection does not primarily explain the origin of species, but only the development of adaptations, and, on the other hand, that the distinctions which it does explain are not confined to species, is the key to the right understanding of this great biological principle. When natural selection did produce species, it was because accidentally the differences to which it gave rise were specific in character: its business was to evolve adaptations.

It is to one among these other causes which have been shown to be necessary for accounting for the origin of species that Dr. Romanes devotes special attention: he calls it the prevention of intercrossing with parent forms, or the evolution of species by independent variation.

The number of trifling variations, even in one generation, is enormous. The fact that natural selection preserves the useful ones alone, and yet can furnish 'the whole adaptive morphology of nature,' gives us a glimpse of the necessarily enormous number of non-surviving, useless variations. Now, if the possessors of any of these useless variations were prevented by any means from intercrossing with those who did not possess them, these unuseful variations would be perpetuated by heredity (witness our domesticated productions), and those varieties of the old species would gradually pass into a new species. On this principle, the opportunities for independent breeding without crossing with the parent forms explains the extraordinary prevalence of peculiar species in isolated oceanic islands. Geographical barriers and migrations can produce the same result. And this hypothesis is made doubly strong by the consideration, that, in these cases where the extinction of the variation has been prevented (by preventing the swamping effects of intercrossing with the parent form), the variations thus perpetuated are generally of a useless character. But the existence of natural barriers will not account for all cases of species-formation by independent variation, because some degree of sterility occurs between even closely allied species, and because closely allied species are not always separated by geographical barriers. The principle of physiological selection must be called in to complete the explanation.

Probably the most variable part of the organism is the reproductive system; and these variations are either in the direction of increased or of diminished fertility. These variations would be more commonly observed, were it not that by their very nature they lead to more or less immediate extinction. But if the sterility were confined largely to crossing between the parent and the varietal form, while the varietal form continued fertile *inter se*, the conditions for the formation of a new species would be furnished. The result of this would be, that, as before, some individuals living on the same area as the rest of their species would be prevented from having progeny with this rest. The only difference is, that in the former case the barrier was geographical: here it is physiological. It is understood, then, that wherever such a variation in the reproductive system occurs that diminishes the fertility between the varietal and the parent form, though retaining it among the varietal, this physiological barrier will end in dividing the species into two sections, each free to develop independent, distinct histories. On this principle, variations in parts other than the reproductive system, unless such variations were useful in character, would not be preserved; but, when the difference in respect of the reproductive system had set in, other differences would secondarily supervene by independent variation. To prevent an unfair objection, it may be added that this theory is not concerned with the kind or cause of this variation any more than that of natural selection: it sets out with the fact.

It will be impossible in so brief a notice to do more than outline the evidence which Dr. Romanes

gathers in support of the hypothesis of physiological selection, on the segregation of the fit. Domesticated varieties cannot show much evidence for physiological selection, because breeders keep their strains separate artificially, and this kind of variation is not in their interest. They do show very strongly, however, how important it is to prevent intercrossing with the parent forms if the varietal form is to maintain itself. It is hardly possible that a species could be formed without the prevention of intercrossing with other forms: it is even difficult to imagine any single variation so intensely useful as to resist the swamping effects of free intercrossing. In the natural state the variation in question would not be noticed until the process were over; and so, as is the case with natural selection, the process cannot be directly observed. But it can be proved that the kind of variation which the theory requires does occur in nature and under domestication. If the season of flowering or pairing were advanced or retarded (and changes in the environment would frequently produce the result), the conditions for physiological selection would be given.

But physiological selection will be best shown in what may be termed 'spontaneous variability of the reproductive system.' Of this fact we have evidence in *individuals* (e.g., Mr. Darwin observes that "it is by no means rare to find certain males and females which will not breed together, though both are known to be perfectly fertile with other males and females"), in *races* (e.g., under domestication, "the yellow and white varieties (of Verbascum), when crossed, produce less seed than the similarly colored varieties" — *Darwin*), in *species* (for, as the distinction between varieties and species is of degree only, and as the main distinction is as regards mutual sterility, every instance of sterility between parent and varietal forms is evidence of the action of physiological selection).

Dr. Romanes then proceeds to show that "the facts of organic nature are such as they ought to be, if it is true that physiological selection has played any considerable part in their causation;" and to do this he shows that the three cardinal objections to the theory of natural selection — namely, sterility, intercrossing, and inutility — find a ready explanation in the hypothesis of physiological selection. In this evidence it is brought out that in all probability the variation in the reproductive system is the primitive and distinctive one in the formation of species, and not that it was developed as secondary to another specific distinction in any other part of the organism. In addition, it is shown that the theory is capable of explaining why species have multiplied, and have not become transmuted in a linear series, and that the large body of favorable evidence furnished by the geographical distribution of organic life is perhaps the strongest argument for the truth of the theory. For the details of these points, reference must be made to the original paper.

A word as to the relation of the theories of natural and of physiological selection. It has already been noticed that the kind of evidence on which each depends is alike; that the former deals with the origin of genera, families, orders, and classes, even more than that of species, while the latter relates to species alone; that the former perpetuates useful distinctions alone, while the latter takes up the non-adaptive kind. It remains to add, that the two theories are in no way opposed to one another, but are complementary and co-operative. Without physiological selection, natural selection would be overcome by the adverse influences of free intercrossing: without natural selection, physiological selection could perpetuate no differences of specific type other than those of mutual sterility and trivial details of structure, form, or color.

In conclusion, Dr. Romanes suggests the following experimental verification of his theory, and asks the co-operation of observers in different geographical areas. The experiment consists in taking well-marked natural varieties of plants, and testing the relative degrees of fertility, first within themselves, and next towards one another; in continuing the process "in successive years over a number of natural varieties, by carefully conducted artificial fertilization, and by counting the seeds and tabulating the results."

LAUNHARDT'S MATHEMATICAL ECONOMICS.

PROFESSOR LAUNHARDT has made what seems to us quite a notable contribution to the literature of mathematical economics in the volume before us. Whatever may be thought of the importance of investigations of this nature, it cannot be denied that the works of the principal writers on the mathematical theory of political economy — Cournot, Walras, Jevons, and perhaps others — are marked by insight as well as ingenuity, and in many respects by true scientific method as well as scientific form. They have nothing in common with that pseudo-science which we occasionally find endeavoring to conceal its emptiness behind a breastwork of mathematical formulas.

Professor Launhardt bases the theory of political economy on the Walras-Jevons idea of utility in

Mathematische begründung der volkswirthschaftslehre. By WILHELM LAUNHARDT. Leipzig, *Engelmann*, 1885. 8°.

relation to value. This may be indicated with sufficient precision in a brief space. One of the first points noticed by economists in the theory of value is that the exchange values of different commodities are not at all proportioned to their utilities. The theory advanced by Jevons — and Walras's is substantially identical with it — points out, that while it is true that the aggregate utility of the whole amount of a given kind of commodity has no relation to its exchange value, yet in a certain sense commodities do exchange in the ratio of their utilities. The total utility of different amounts of the same commodity is not proportional to the amount: as successive equal increments are added to the existing quantity, they add less and less to the aggregate utility. Now, what the theory asserts is, that the exchange value of any commodity is determined by the utility which would result from the addition of a small quantity of it to the amount already possessed. Thus commodities do not, indeed, exchange in the ratio of their *total* utility, but they do exchange in the ratio of their *final* utility; that is, of the utility of the last small portion produced, or, what is the same thing, of the next small portion that might be produced. The total utility, u, of the whole quantity, x, of a given commodity, is, then, given by an equation,

$$u = f(x),$$

which may be called the utility-equation; and the exchange value of the commodity is proportional to the derivative of u with respect to x. We might conceivably obtain the form of the utility-equation of any article from a study of its commercial statistics; but this has not been done for any commodity, and it may be doubted whether it ever can be done — with even the lowest tolerable degree of accuracy — unless, possibly, in some very peculiar cases. We do know, however, in practically every case, that $f(x)$ increases with x, but increases at a diminishing rate; that it is 0 when $x = 0$, and reaches a maximum for some value of x. This last point might at first sight be doubted, for it is equivalent to saying that for every commodity there is a point beyond which the quantity on hand cannot be increased without its becoming a nuisance; but it is plain that such a point does in general exist, though it may be very far beyond the quantity actually possessed.

What Launhardt has added to the work of his predecessors is chiefly the discussion of a large number of applications of the general theory, — a discussion which was in most instances made possible only by a special and arbitrary assumption concerning the form of the utility-equation. Since the function $ax - bx^2$ (where a and b are positive constants) is a very simple function, possessing the properties above mentioned as belonging to the utility-function, — viz., it is 0 when x is 0, then increases but at a diminishing rate, and reaches a maximum at a certain point, — Launhardt adopts it, stating at the outset that he would employ it for purposes of illustration, but insensibly falling into the way of deducing from the assumption of its sufficiency the greater part of his theorems. That the form is not sufficiently general for even the roughest approximation, despite the fact that the choice of different coefficients, a and b, gives a wide range for the different characters of different commodities, one may easily convince himself. The derivative of $ax - bx^2$ is $a - 2bx$: accordingly, the exchange value of a unit of any commodity would be a linear function of the entire quantity of that commodity available; so that, if we consider any three quantities, x_1, x_2, x_3, such that x_2 is the arithmetical mean of x_1 and x_3, the exchange value of the article when the quantity is x_2 would necessarily be a mean between its values when the quantity is x_1 and x_3. This is certainly not even approximately true for commodities in general; and this consideration alone would be sufficient to justify us in not accepting the form $ax - bx^2$ as sufficiently general for purposes of investigation. Indeed, as already stated, the author seems to have had no deliberate intention of so using it.

We have dwelt at some length on this point, because the most striking conclusions in the first section of the book — that devoted to exchange — are dependent upon it. One or two theorems of this kind may be quoted, and they will also serve to indicate the nature of the questions discussed by the author. The theorems are printed in italics, as embodying the net outcome of the mathematical investigations which precede them.

"When the merchant is so placed that he can fix his rate of profit at the point most advantageous to him, he obtains two-thirds of the entire economic gain accomplished by the exchange, or twice as much as the producer and consumer together.

"The most advantageous duty is therefore equal to one-third the difference between the price which the domestic goods would bring if there were no importation, and the price at which the foreign goods could be sold with no profit to the producer."

The simplicity of these results is equalled by their unreliability. It is not very surprising that a simple result should be reached from a mathematical hypothesis so much simpler than the facts warrant, even for the purposes of the purest theory; but, in spite of the small value of the re-

sults, the methods of arriving at them, often ingenious and depending on a refined analysis of the subject-matter, seem to us of decided interest to any who may be considering the part which mathematical methods are capable of taking in the development of economic science. We cannot here enter upon a discussion of this general question; but we may be permitted to say that we do not look forward to their giving important direct aid in the investigation of the fundamental questions of economics, though they may, when the science has reached a more advanced stage, be useful in the more minute discussion of special problems. In a certain indirect and incidental way, we think that mathematical inquiry may be useful even to the fundamental theory; for the necessity under which the mathematician lies, of clearly and exactly comprehending his premises, will doubtless in some instances bring about a more accurate view of economic phenomena. Upon the mathematical economists themselves, this necessity of accurate definition is apt to act in a most harmful manner, as their writings abundantly prove. When they have got hold of a notion which lends itself to mathematical treatment, the temptation is very great to unduly extend its province. Jevons's theory of utility in relation to value is a conspicuous example of these merits and defects. While the accurate analysis of some features of the phenomena of value which was a necessary preliminary to the mathematical discussion has been useful to economists in general, the results reached by the mathematical theory are open to the gravest objections; and this quite apart from any subsidiary defects, such as those occurring in some of Launhardt's discussions, as pointed out above. In the mathematical development of the theory, its exponents overlook two capital points, — first, that, under a *régime* of separation of employments, the direct utility of a product to its producer has little or no significance; secondly, that, when an addition to the amount of a given commodity supplies with it a new class of individuals who formerly could not possess it, the utility thus arising is very different — and, if measurable at all, its amount follows a very different law — from that which arises from an increase in the quantity possessed by those who were already provided with the commodity.

We have not left ourselves space to speak of other points, some of them very interesting, in the section on exchange, nor to make more than a passing mention of the other two sections, on production and transportation respectively. On the subject of money, the author takes, in our opinion, a very erroneous view. In the section on transportation, the mathematical premises come nearer than almost anywhere else to a representation of the actual problem: a large part of the questions there discussed are, in fact, such as are necessarily considered in an essentially mathematical way, though doubtless with little scientific method, by railroad managers. A satisfactory idea of the book can only be obtained by reading it. For the benefit of those who may contemplate doing so, we may state that a knowledge of the first elements of the differential calculus will make the little volume of two hundred pages sufficiently easy reading.

THE POPULATION OF MEDIAEVAL CITIES.

SOCIAL science has certain problems of reconstructing past conditions out of fragmentary remains, which are analogous to that reconstruction of terrestrial life and conditions which has been the triumph of modern natural science. History does not now content itself with a mere narration of events, but strives to portray the whole social condition of the people, — to give a vivid picture of society as it existed at the time. Modern historical writing has accomplished this to a greater or less extent, and the result is that our histories are histories of the people rather than of dynasties.

In one particular, however, this reproduction is incomplete. The historians do not give us exact statistical details of the relations of population, industry, commerce, etc., without which any description of a modern community would be considered entirely incomplete. It is impossible for them to do so, because such statistical investigations are entirely modern, most of them reaching back only to the beginning of this century. In former times there were no statistical bureaus, no census of the people, no returns of trade and commerce. There was no demand for such information, either for governmental or scientific purposes. It is notorious that ancient and mediaeval writers had no sense for numbers. The figures they give of the strength of armies or the population of cities are mere estimates, and on the face of them are often obvious exaggerations. One of the most difficult problems the historian has before him, is to weigh the statements of different writers as to the number of people concerned in any event, and very few purely literary historians have the requisite scientific training for such work.

The pure historian must here appeal to the professional statistician for help. The acute and learned work of which we give the title is an example of what German industry can accomplish

Die volkszahl deutscher städte zu ende der mittelalters und zu beginn der neuzeit. Von J. JASTROW. Berlin, *Gaertner*, 1886. 8°.

in this direction. It takes up the question of the population of mediæval cities, and explains elaborately the methods of ascertaining such population. Of actual censuses of the people, we have but two cases, — Nuremberg, in 1449; and Strasburg, in 1475. The first was to estimate how long the corn would last during a siege; the second, to get at the military strength of the city. With these two exceptions, all our knowledge of the population of mediæval cities rests on estimates of various kinds. Sometimes we have the number of houses in a city, and can guess at the population by reckoning the probable number of people to a house. The old church registers give the births, deaths, and marriages, and from these we can estimate the number of inhabitants. Finally, there are the tax-lists and the army-lists, occasionally a list of persons enjoying citizenship, or statistics of the consumption of the chief commodities. Our author points out, however, that all these estimates must be accepted very cautiously, because we are not accurately acquainted with the relations of mediæval life so as to reason, for instance, from the consumption of meat in a city to the number of people.

The actual population of mediæval cities appears from this scientific investigation to have been astonishingly small. Those imperial cities, which ruled themselves, bade defiance often to the emperor, and played an important part not only in the industrial but in the political life of Europe, we are accustomed to think of as places rich in wealth and population. In the fifteenth century, Nuremberg, Strasburg, and Dantzic, three very important commercial cities, probably contained less than 20,000 people each; Basle and Frankfort, from 10,000 to 15,000 each. In the sixteenth century Augsburg and Dantzic reached possibly 60,000; Nuremberg, from 40,000 to 50,000; Breslau, 40,000; Strasburg, 30,000; Leipzig, 15,000; and Berlin, 14,000. These were by far the most important cities of the empire. The other so-called cities were villages and market-places running down to from 1,200 to 1,500 people.

Richmond Mayo Smith.

A Vienna workman sick with sore throat was ordered a gargle of chlorate of potash. The prescription called for 'a coffee-spoonful in a glass of water,' although verbal instructions were given that it was to be used as a gargle. The wife of the sick man gave him a teaspoonful of the chlorate of potash dissolved in a tumbler of water, repeated the dose in an hour, and at four and again at five hours subsequently gave half a teaspoonful. After suffering with cramps and diarrhœa, followed by profuse perspiration, the patient became unconscious, and died the following morning, twelve hours after taking the first dose. Dr. Fountain, who did much to bring this remedy to the notice of the medical profession more than twenty years ago, in order to demonstrate its harmlessness, took an ounce, and died seven days after. Dr. Tully repeated this dangerous experiment on several occasions without any bad results. It is probable that the difference in the results in these two cases was due to the difference in the concentration of the solution.

— In 1884 there were 284,115,862 passengers carried by the railroads in New York City; and, as statistics show an annual increase of twenty millions in the number of passengers carried, the railroads should receive a total of at least 320,000,000 fares during the present year. At five cents each, this would give sixteen million dollars as New York's care-fare bill for 1886.

— The herring fishery in Scotland this year presents some features of interest. About a century ago the estuary of the Moray Frith was most sought after, and fishermen, both local and from a distance, caught large quantities of fish there. But in a most unaccountable manner the herrings suddenly disappeared about forty years ago, and were found only in shoals about the entrance of the frith and on the Caithness side. There, also, the inshore fishery became unproductive; and it was not until new haunts were discovered on the Dogger bank, from thirty to forty miles off the land, that the fishery again became abundant. On this bank heavy fishings are obtained, so that the produce of last year's fishing on the east coast was estimated at nearly $7,500,000. Meanwhile, Shetland had yielded but poor returns as a fishing-ground until 1877, when a beginning was made, and in 1885 the fish cured there amounted to 370,000 barrels. This year, however, the fishing at Shetland has been a comparative failure; but in the mean time the herring has returned to his old haunts in Moray Frith, and the fishing on the east side has of late been very successful. The total catch for the present year, up to the middle of August, is estimated at upwards of 250,000 barrels.

— A new method of preparing fresh fish for transportation to distant markets is being tried at North Sea fishing-ports. The fish are packed in steel barrels, in an antiseptic solution of three per cent boracic and tartaric acids and salt in ninety-seven per cent pure water, the liquid being forced in under a pressure of sixty pounds to the square inch. Fresh fish thus prepared are now supplied to the London markets from the Danish, Scottish, and Shetland Island fisheries.